ReactJS.

The Component model

Topics

- **Component State**
  - **Basis for dynamic, interactive UI**
- **The Virtual DOM**
- **Data Flow patterns**
- **Lifecycle methods**

Component DATA

- **Two sources of data for a component:**
  1. **Props - Immutable; Passed in to a component.**
  2. *State* **– Dynamic; Managed internally by the component**
     - ***** The basis for dynamic and interactive Uis *****

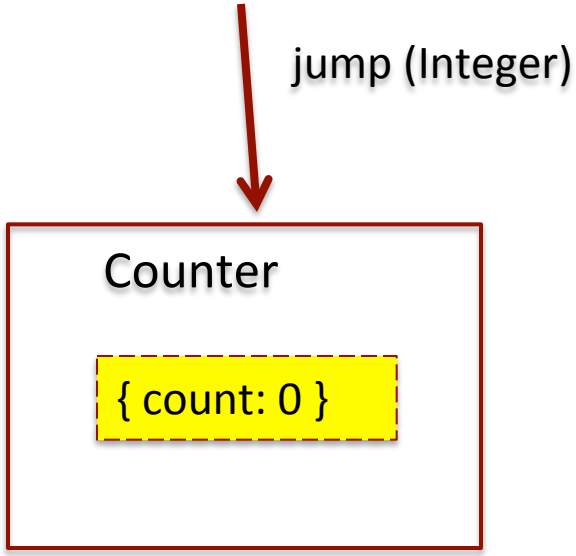
- **Props-related component features:**
  - **Set default prop values.**
  - **Type-checking.**

- **State-related component features:**
  - **Initialize state values.**
  - **Change the state values- the setState() method.**
    - **Change some or all state values (merge, not overwrite).**
    - ***** Automatically causes component to re-render. *****

Component State - Example

- **The Counter component.**
- **Ref. 06_state.js**

- **Component class coding features:**
  1. **Custom functions, e.g. incrementCount().**
  2. **Static class property, e.g. defaultProps.**
  3. **Class instance property, e,g. state.**



React's event system.

- Cross-browser support.
- Event handlers receive SyntheticEvent – a cross-browser wrapper for the browser's native event.
  - Same interface as native event
- Event naming convention slightly different from native:

React	Native
onClick	onclick
onChange	onchange
onSubmit	onsubmit

- See https://reactjs.org/docs/events.html for full details,

Re-rendering

- EX.: The Counter component.

User clicks ‘increment’ button

→ onClick event handler (incrementCounter) executed

→ state is changed (setState())

→ render() method executed

Modifying the DOM

- **Traditional performance best practice:**
  1. **Avoid expensive DOM operations.**
  2. **Minimize access to the DOM.**
  3. **Update elements offline before reinserting into the DOM.**
  4. **Avoid tweking layouts in Javascript.**

- **Should the developer be responsible for low-level DOM optimization? Probably not.**
  - **React solution is the Virtual DOM.**
  - **A challenge to established thinking!**

The Virtual DOM

- **Re-render everything on every update.**
  - **Sounds expensive!**

- **How?**
  1. **Create lightweight description of app's UI (The Virtual DOM)**
  2. **Perform *diff* operation between it and the previous (virtual) UI state.**
  3. **Compute the minimal set of changes to apply to (real) DOM.**
  4. **Batch execute all updates to real DOM.**

- **Benefits:**
  a) **Clean – Clean, descriptive programming model**
  b) **Fast - Optimized DOM updates and reflows.**

Re-rendering (detail)

- **EX.: The Counter component.**

User clicks 'increment' button

→ *onClick event handler (incrementCounter) executed*

→ *state is changed (setState())*

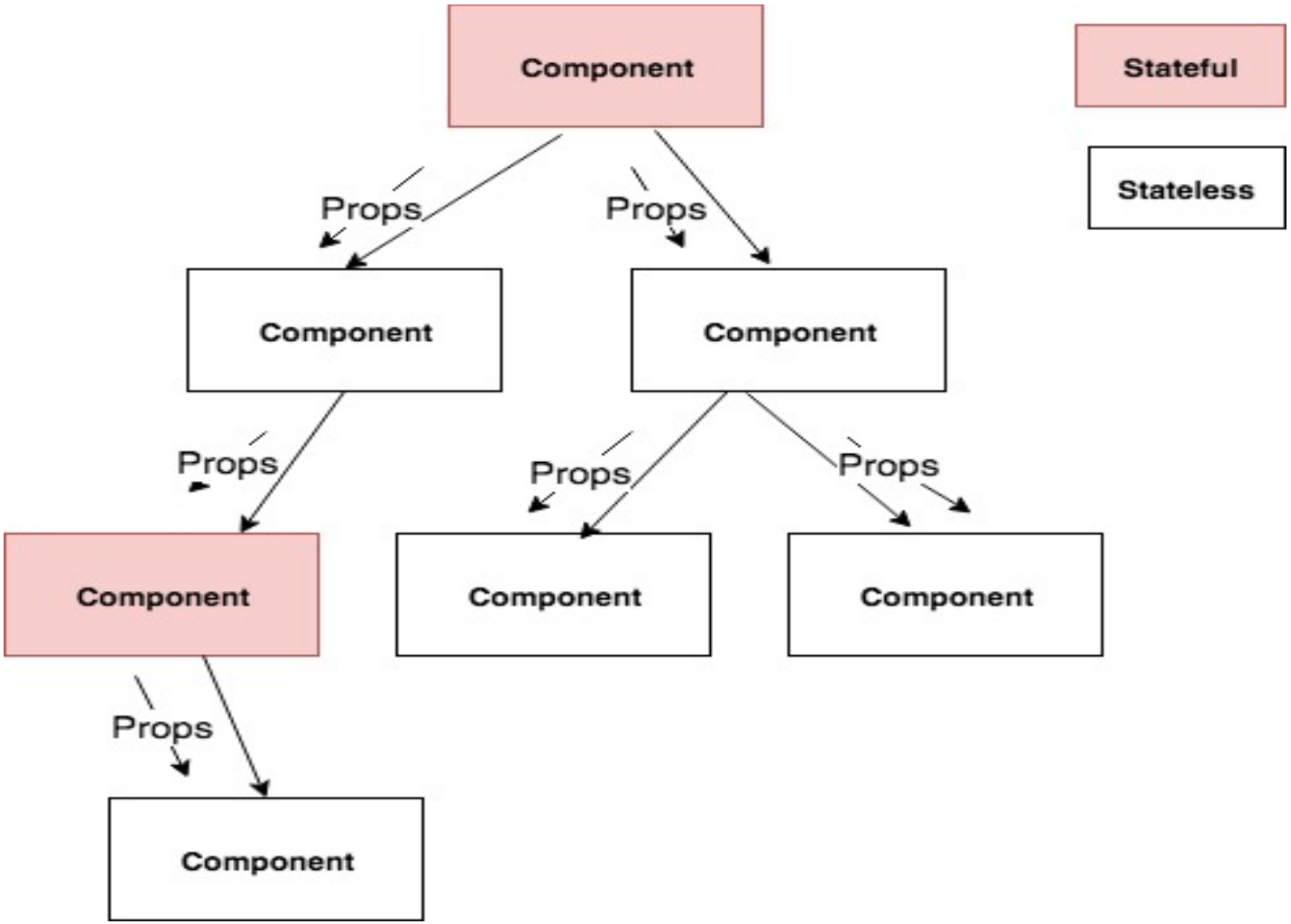
→ *render() method executed*

→ *The Virtual DOM has changed*

→ *React diffs the changes (between the current and previous Virtual DOM)*

→ *React batch updates the Real DOM*

Unidirectional data flow

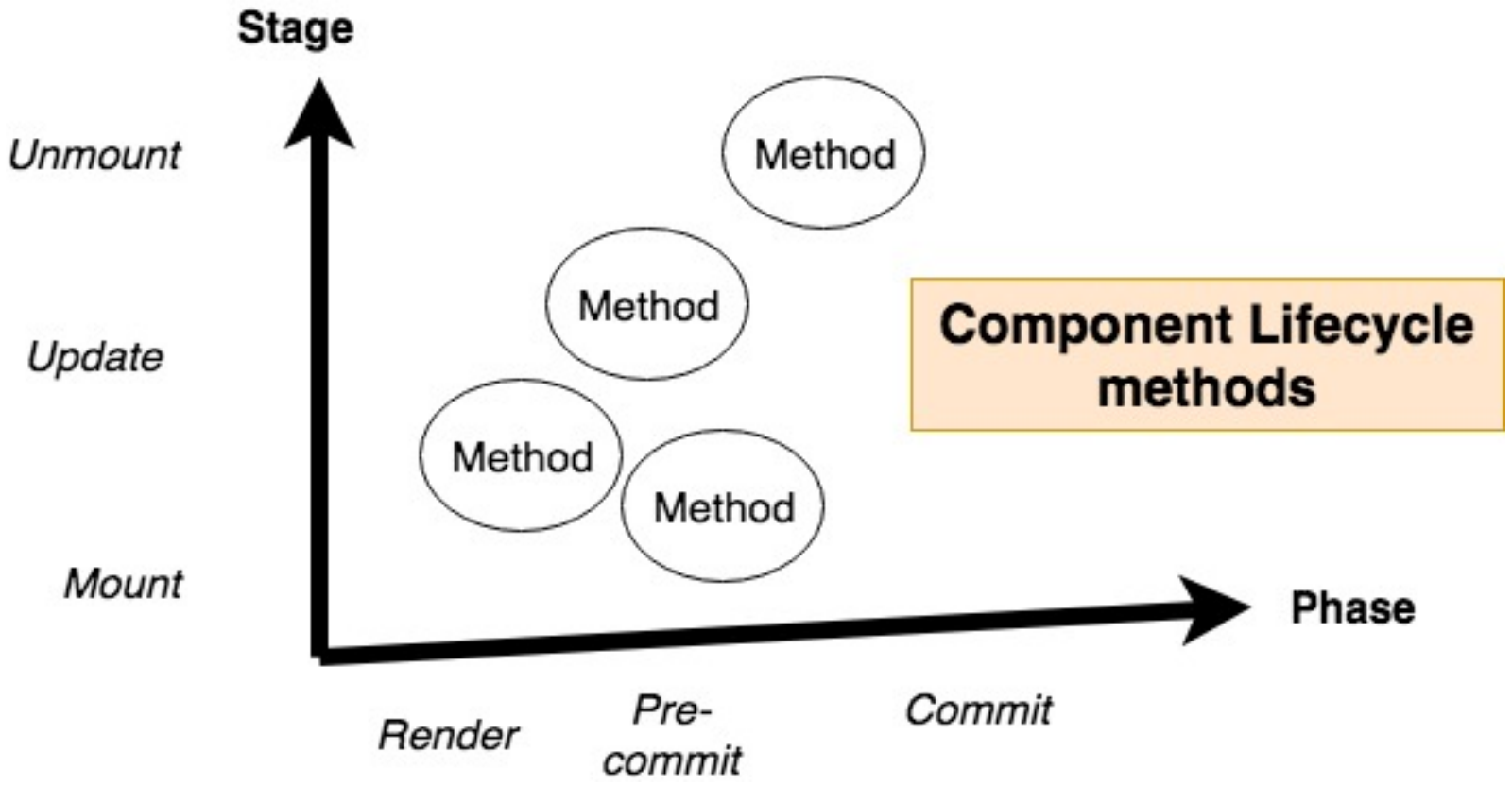


Unidirectional data flow

- **In a React app, data flows uni-directionally ONLY.**
  - **Most other SPA frameworks use two-way data binding.**

- **In a multi-component app, a common pattern is:**
  - **A small subset (maybe only 1) of components will be statefull – the majority will be stateless.**
  - **Statefull components:**
    - **Pass state changes to subordinate components via props, If necessary.**
    - **Calls *setState*() to update its state.**
      - *React guarantees subordinate components are re-rendered with new prop values.*

Component *Lifecycle methods*



Component *Lifecycle methods*

- **Methods invoked by React at specific times in a component's lifecycle (Most are optional).**

- **Lifecycle stages:**
  1. **Mounting (Initialization).**
  2. **Update.**
     a) **New props.**
     b) **setState();.**
     c) **forceUpdate.**
  3. **Un-mounting.**

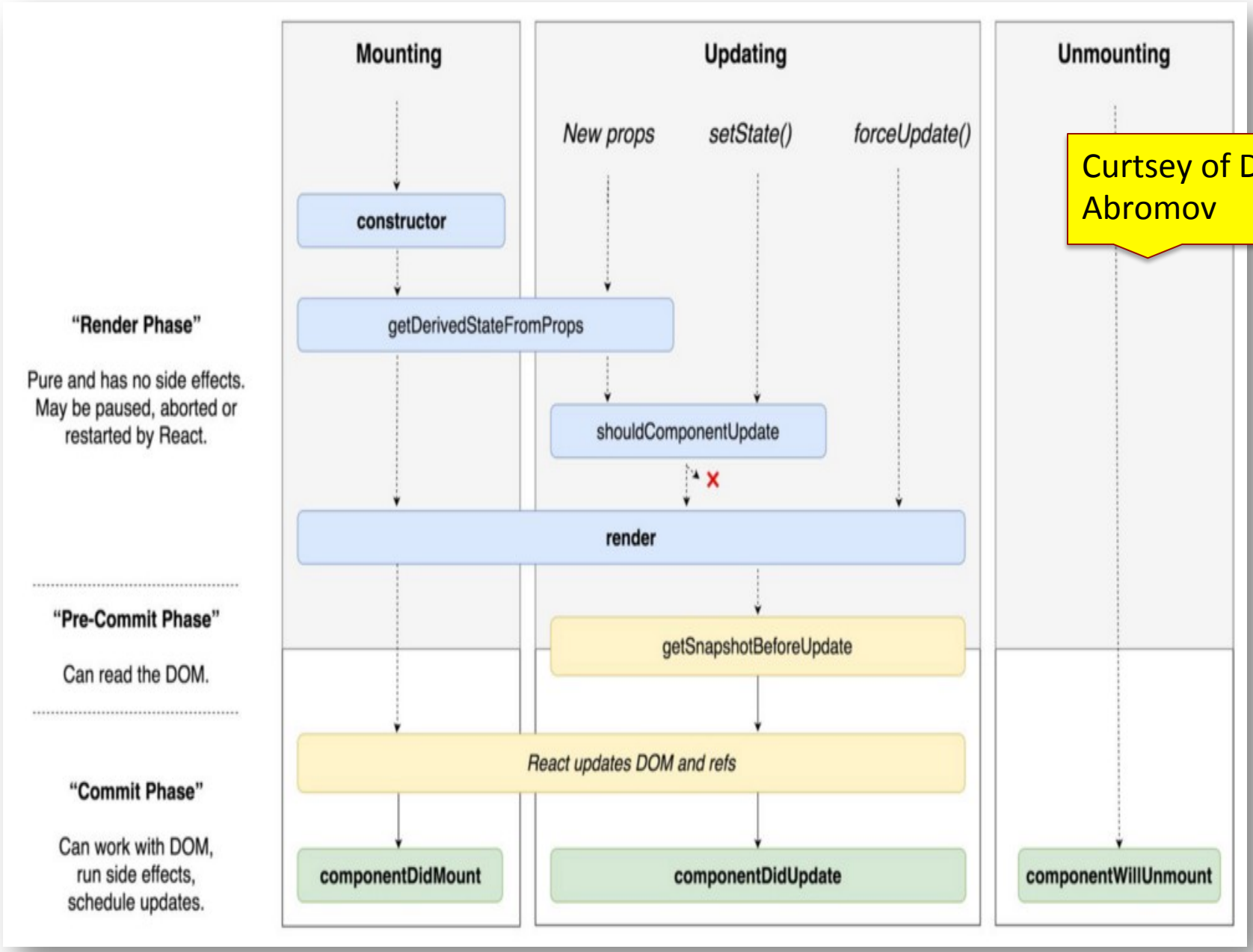
- **Phases:**
  - **Render phase.**
  - **Pre-commit phase (Pre DOM update)**
  - **Commit phase (Post DOM update)**
  - **.**

The Lifecycle methods

- shouldComponentUpdate**() – returns boolean – can cause a component to skip re-rendering.**
- getDerivedStateFromProps**() - when a component state object is computed from its prop values.**
- componentDidUpdate**() – executed after a rendering has updated real DOM; used to perform real DOM manipulatio, e.g. set up external subscription or cause side-effect.**
- componentDidMount**() – executed once, after component has mounted (see later)**
- **componentWillUnmount(); executed before a component is about to unmount; Perform cleanup operations, e.g. remove external subscription.**

The Lifecycle methods

- *shouldComponentUpdate()* ✔
- *getDerivedStateFromProps()*
- *render().* ✔
- *componentDidUpdate()*
- *componentDidMount()* ✔
- *componentWillUnmount***()**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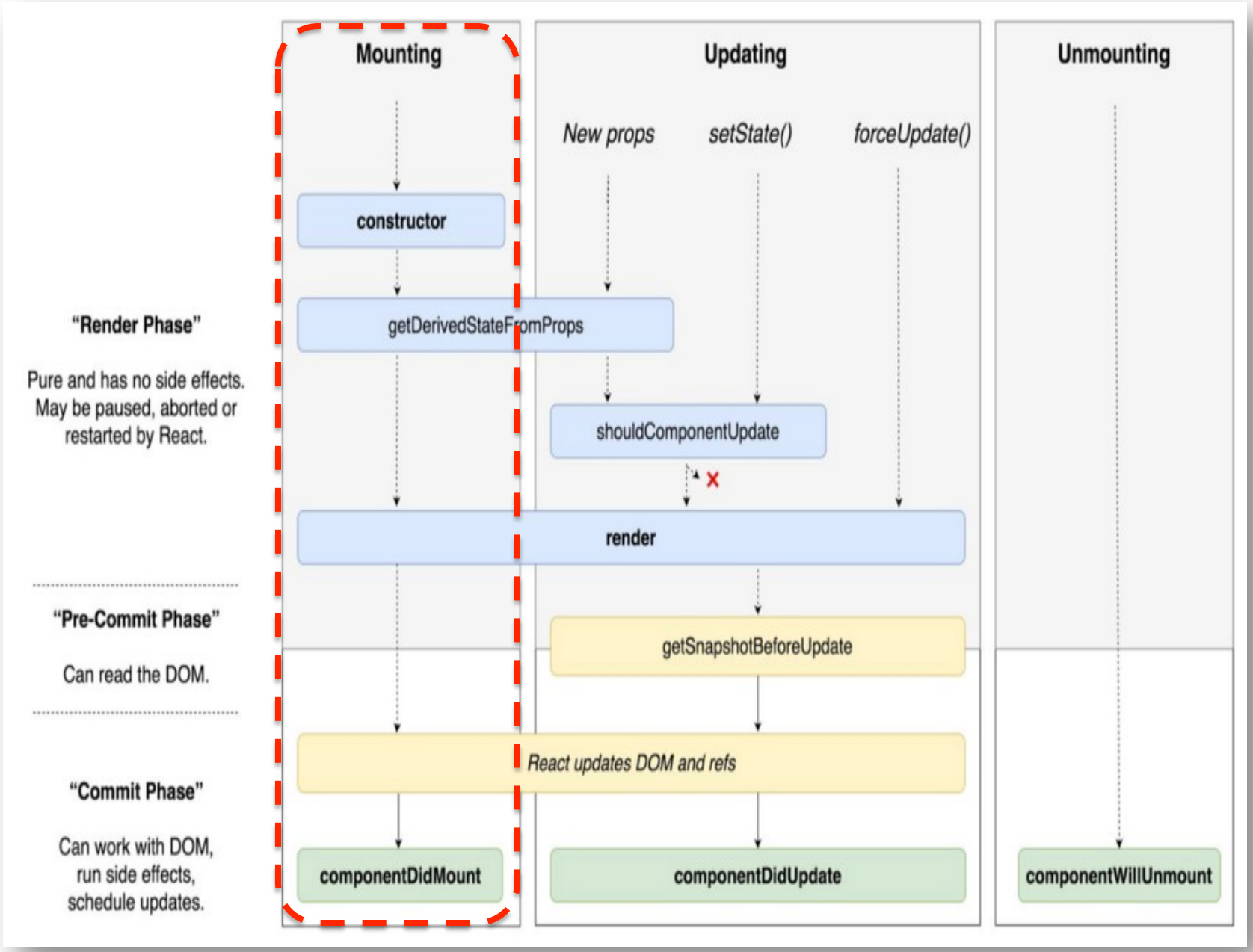
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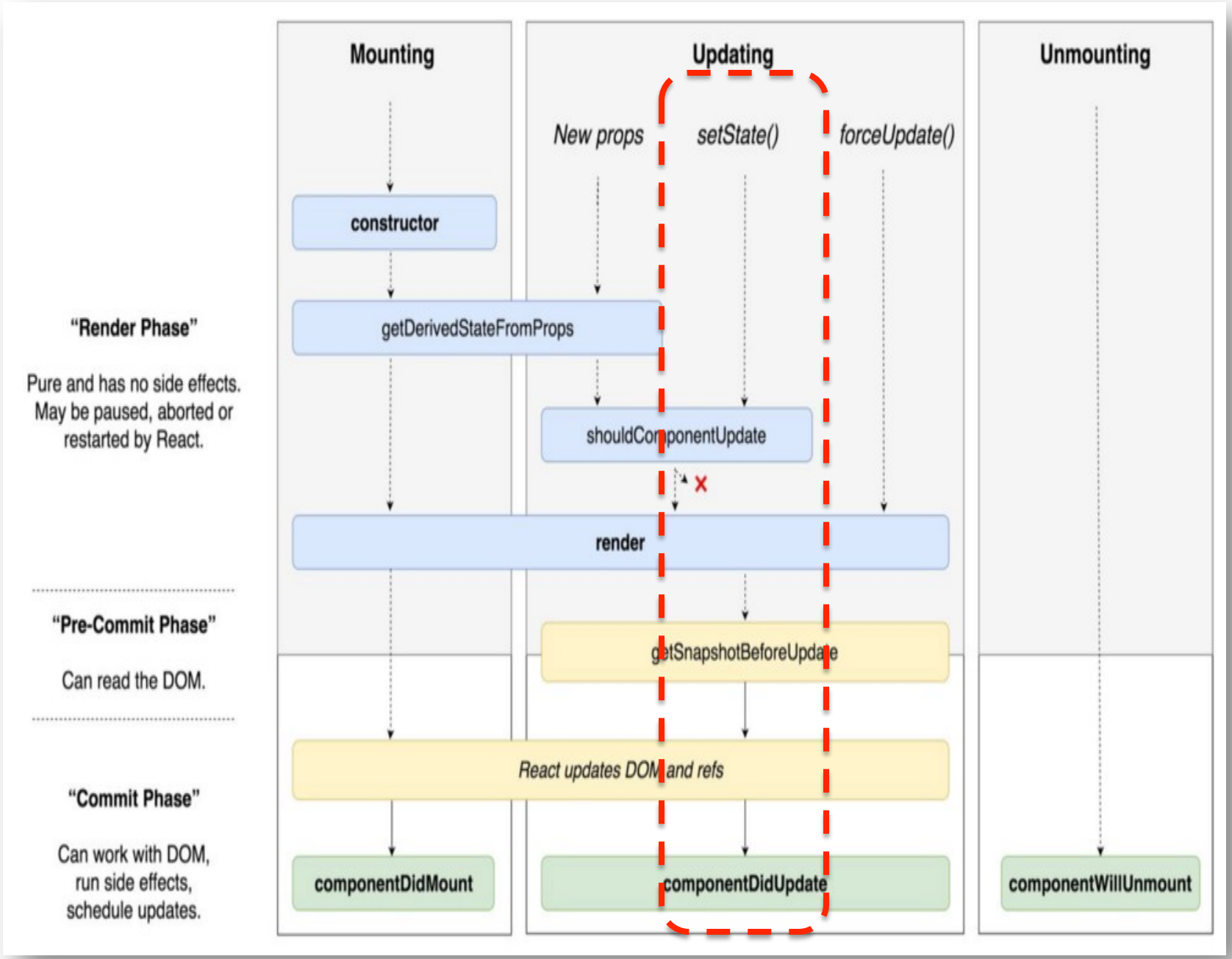
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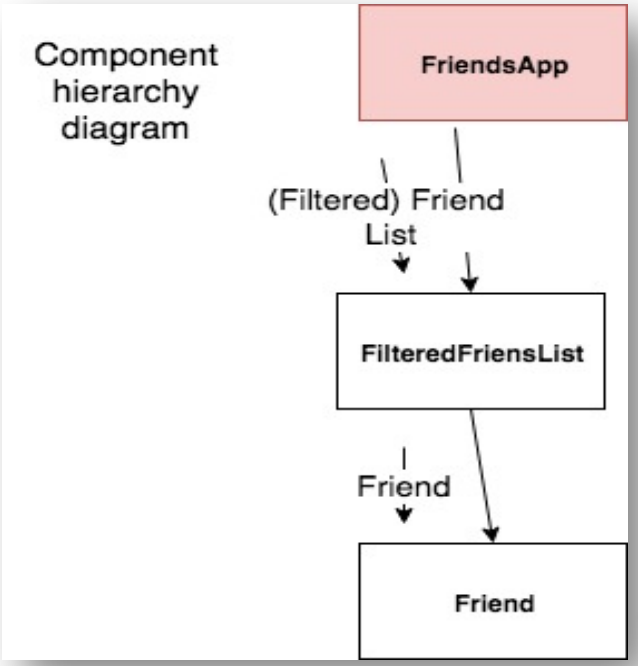
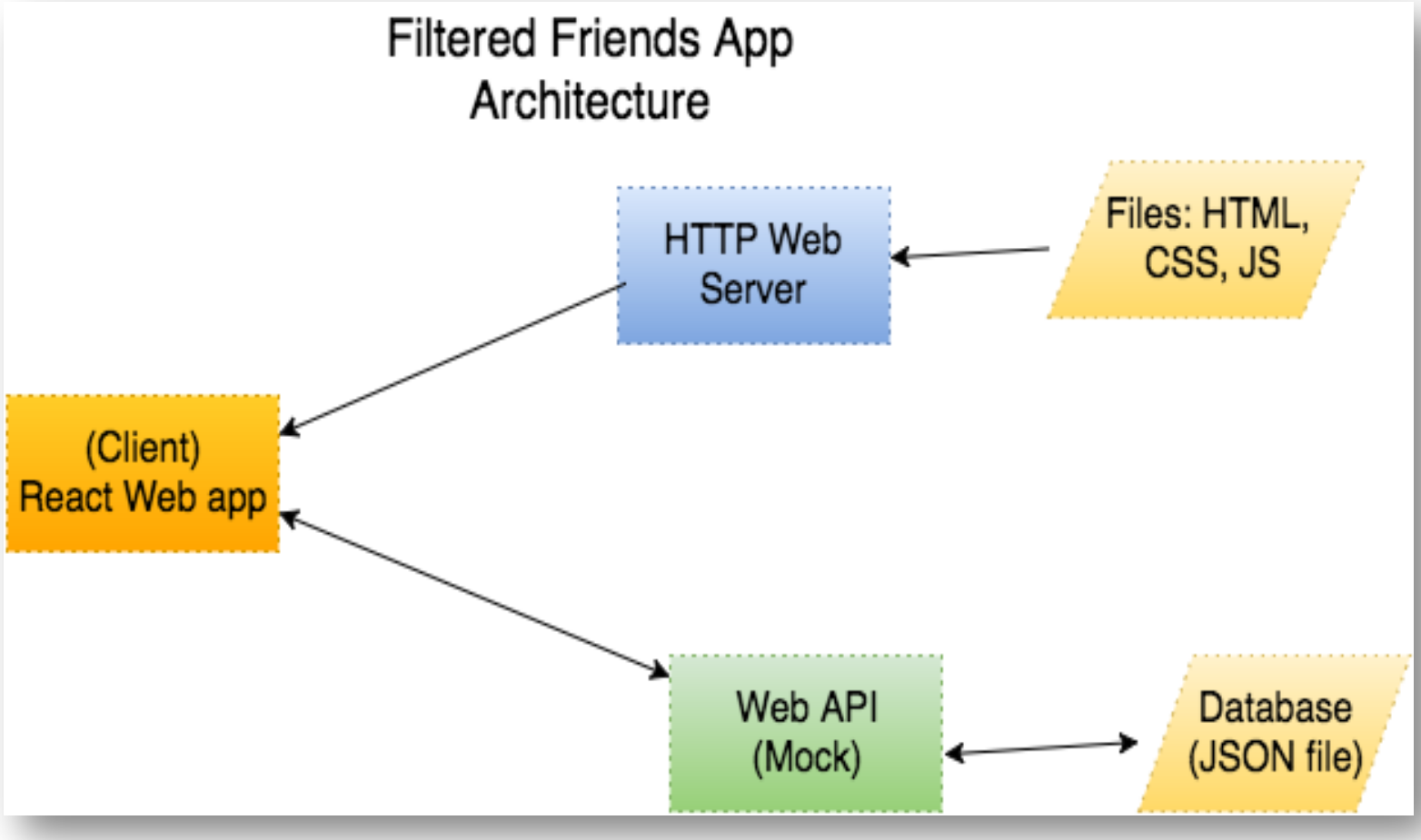
Sample App



***FriendsApp* component:**

1. **Manages app's state (i.e. text box content).**
2. **Computes matching friends list.**
3. **Controls list re-rendering.**

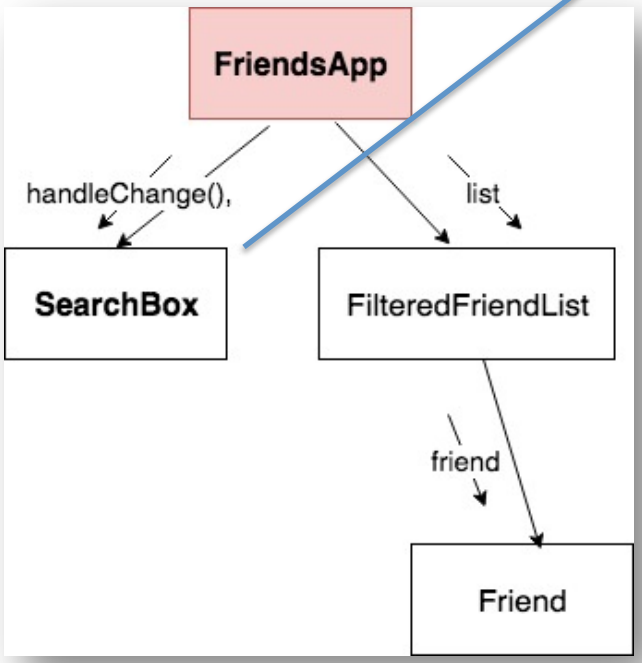
Sample App – Architecture..

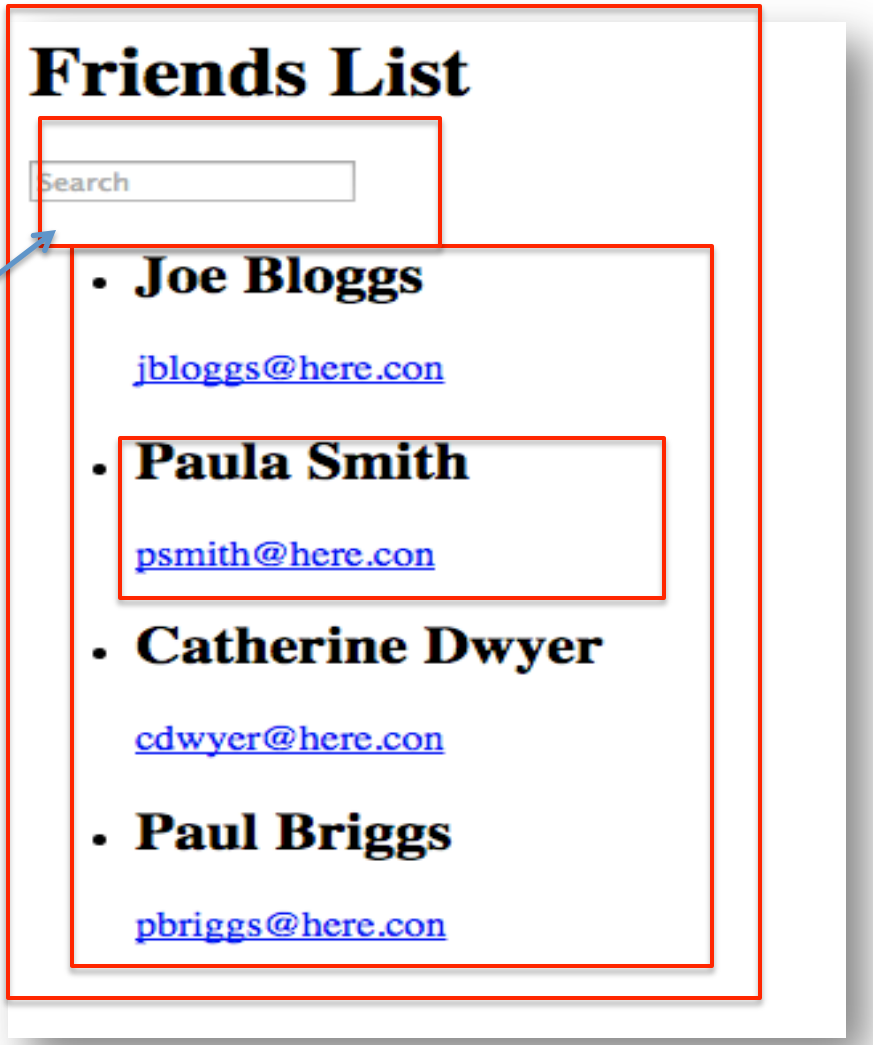


DEMO

Inverse data flow

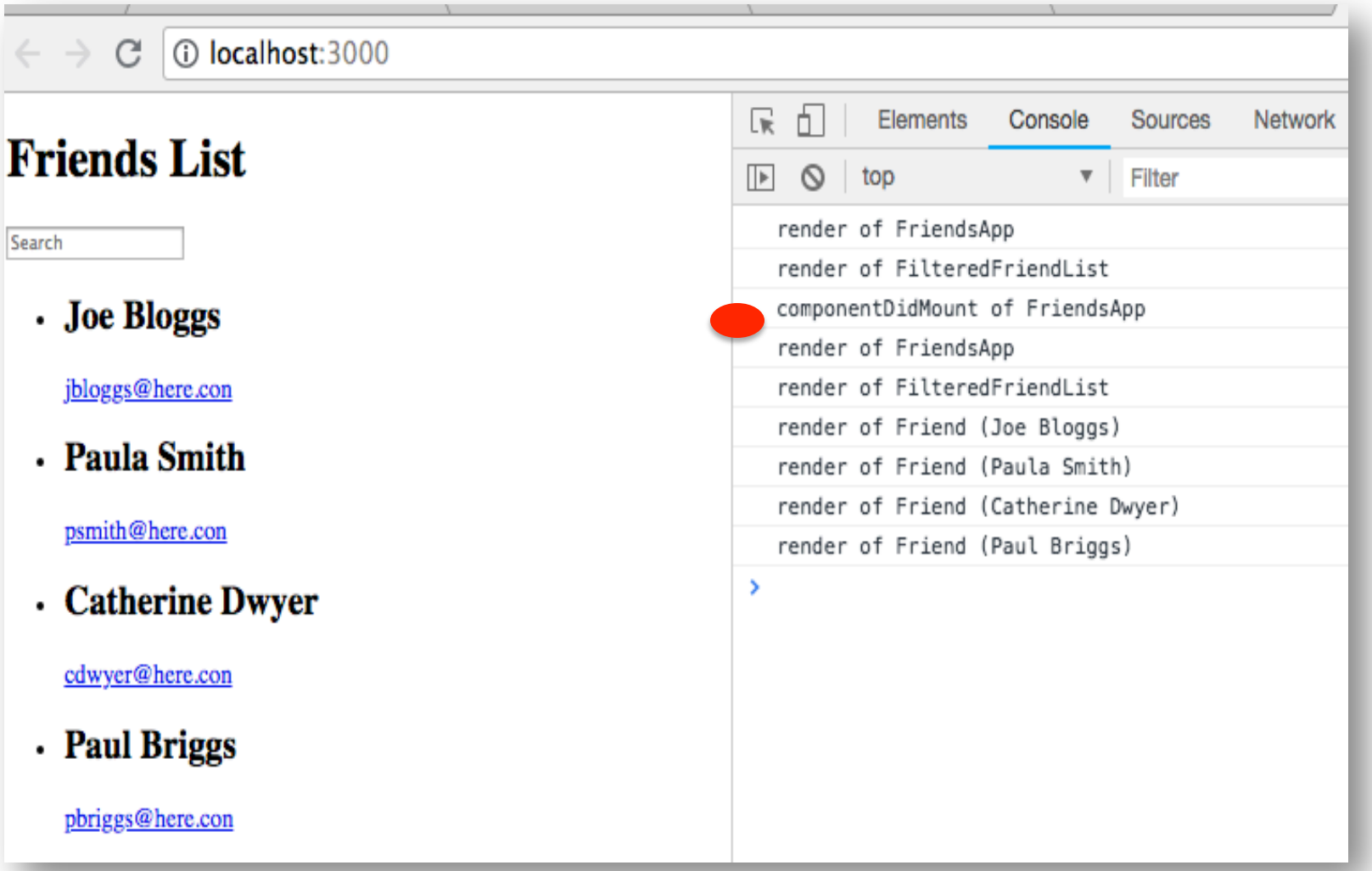
- **What if a component's state is effected by an event in a subordinate component?**
- **Solution: The** inverse data flow pattern.

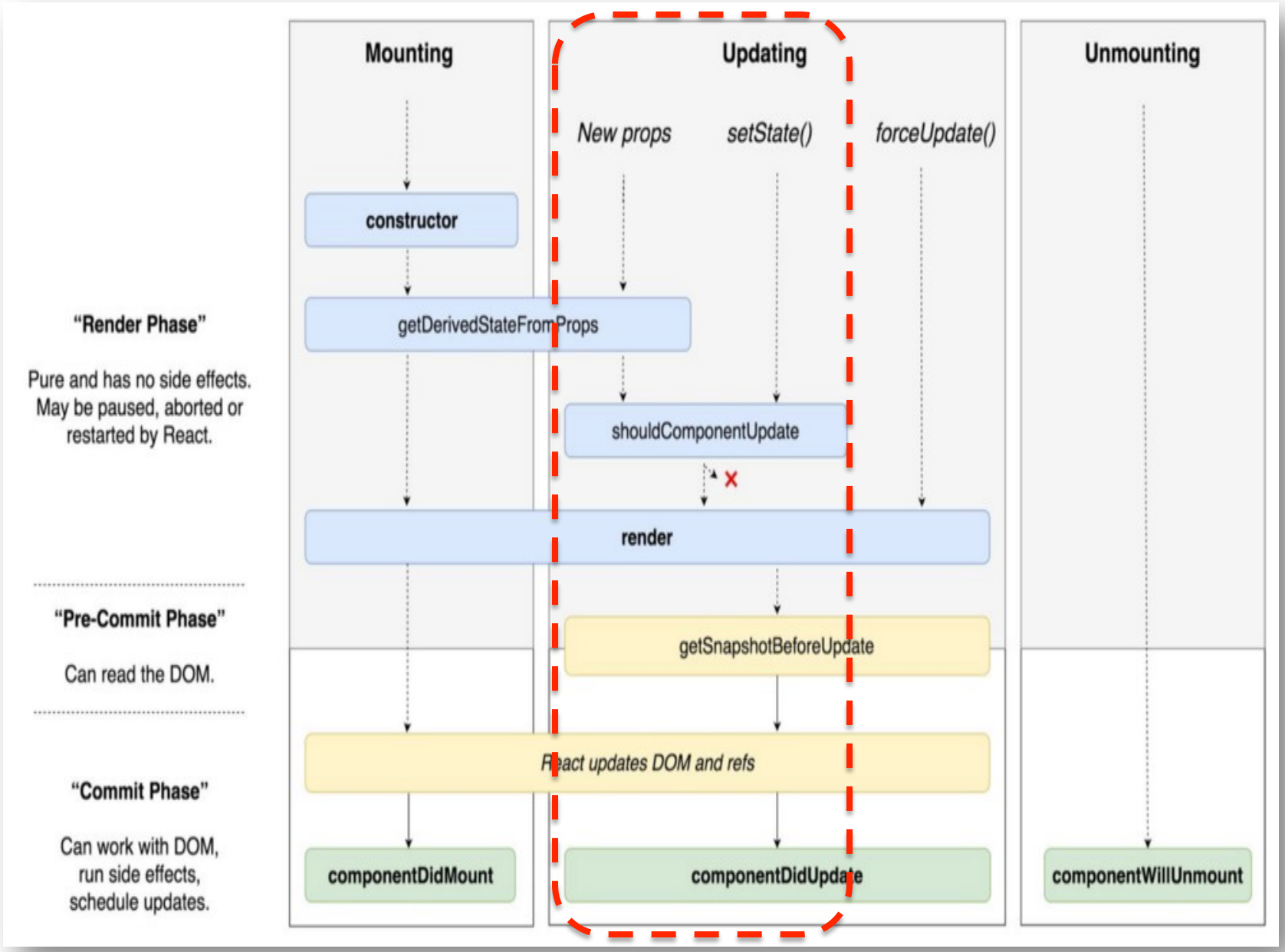




. . . . . back to Lifecycle methods . . . .

Sample App – Execution trail (Mounting & setState)..

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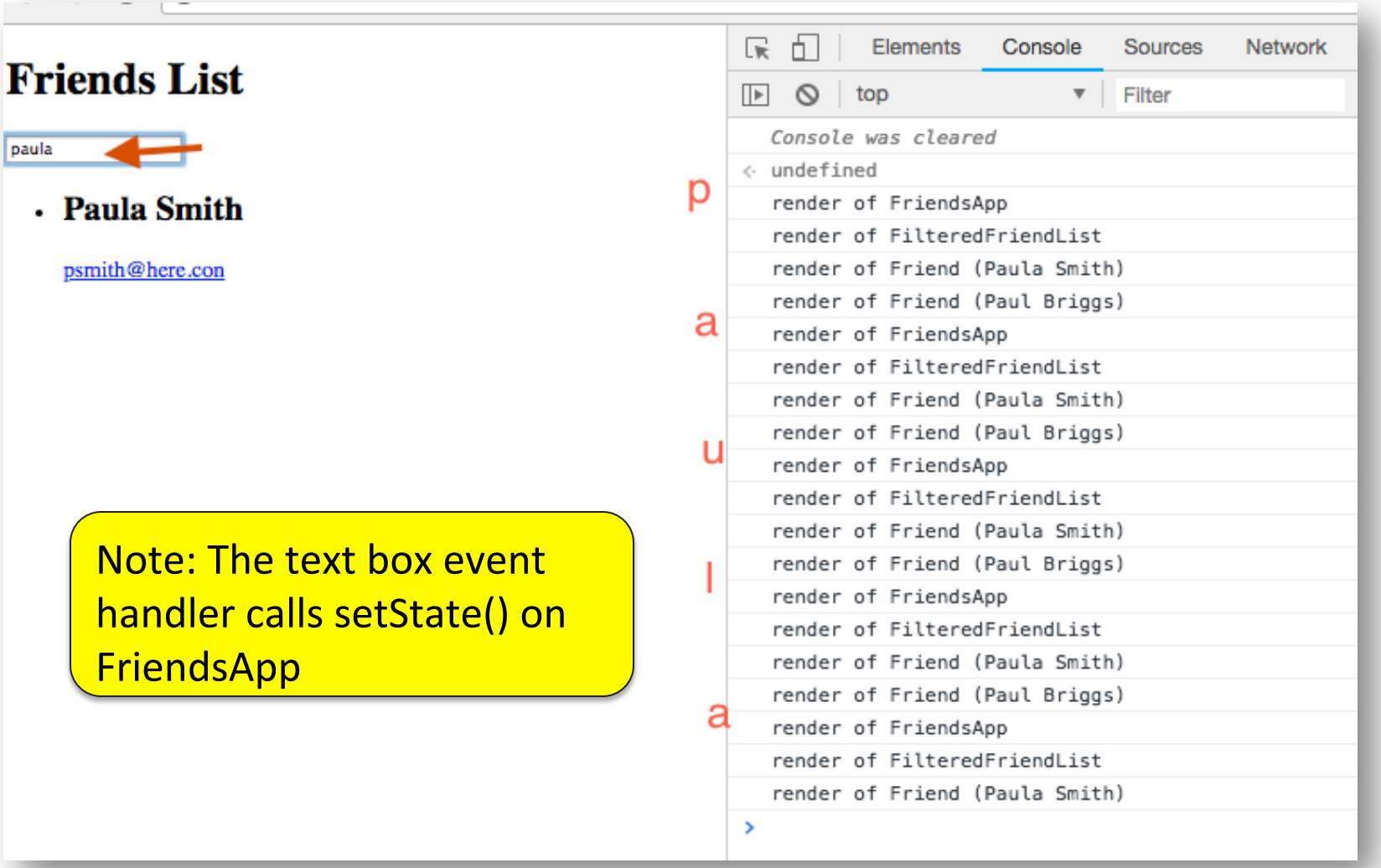
Sample App – Execution trail (Update on new props & setState)..



Note: The text box event handler calls setState() on FriendsApp

Unidirectional data flow & **Re-rendering**

- **What happens when user types in to text box?**

  User types a character into text box

  → *onChange* ***event handler executes***

  → ***Handler calls setState()*** *(FriendsApp* ***component)***

  → ***React calls*** *FriendsApp* ***render() method***

  → ***React calls render() method of children*** *(FilteredFriendList)* ***with new prop values***

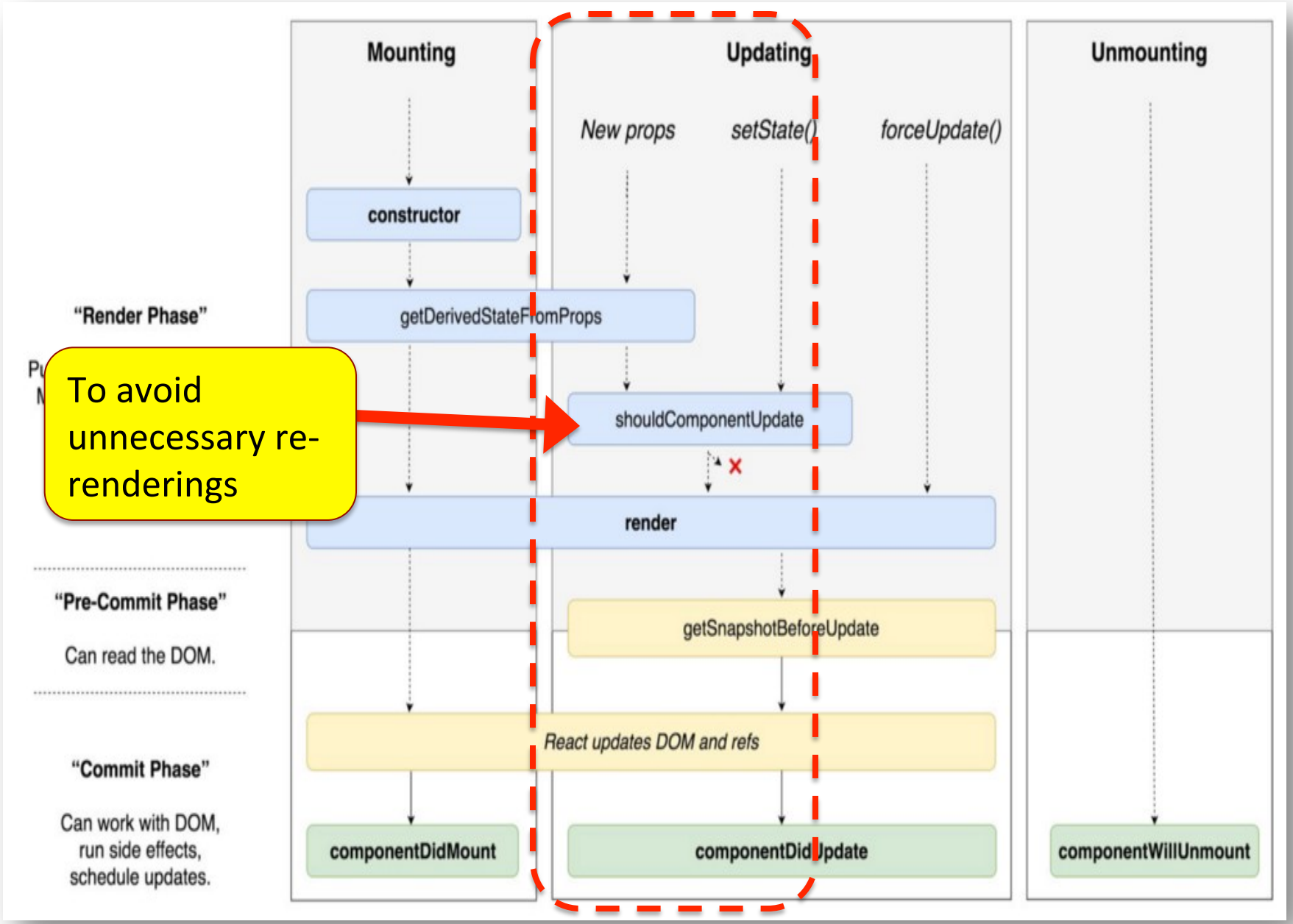
  → ***React calls render() method of*** *FilteredFriendList* ***children.***

  → ***(Pre-commit phase) React re-computes the new Virtual DOM***

  → ***React diffs the new and previous Virtual DOMs***

  → ***(Commit phase) React batch updates the Real DOM***

  → ***Browser repaints screen***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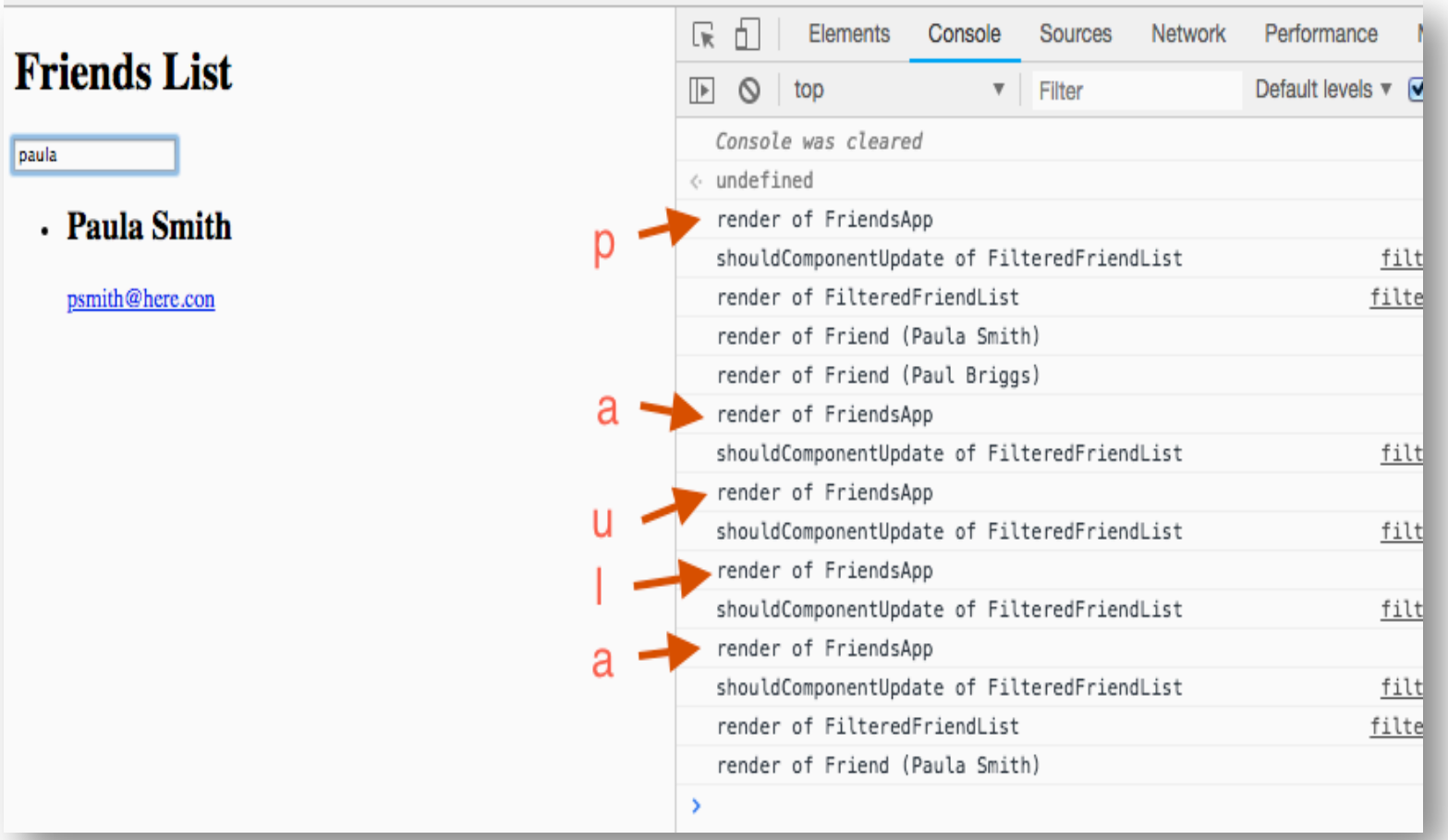
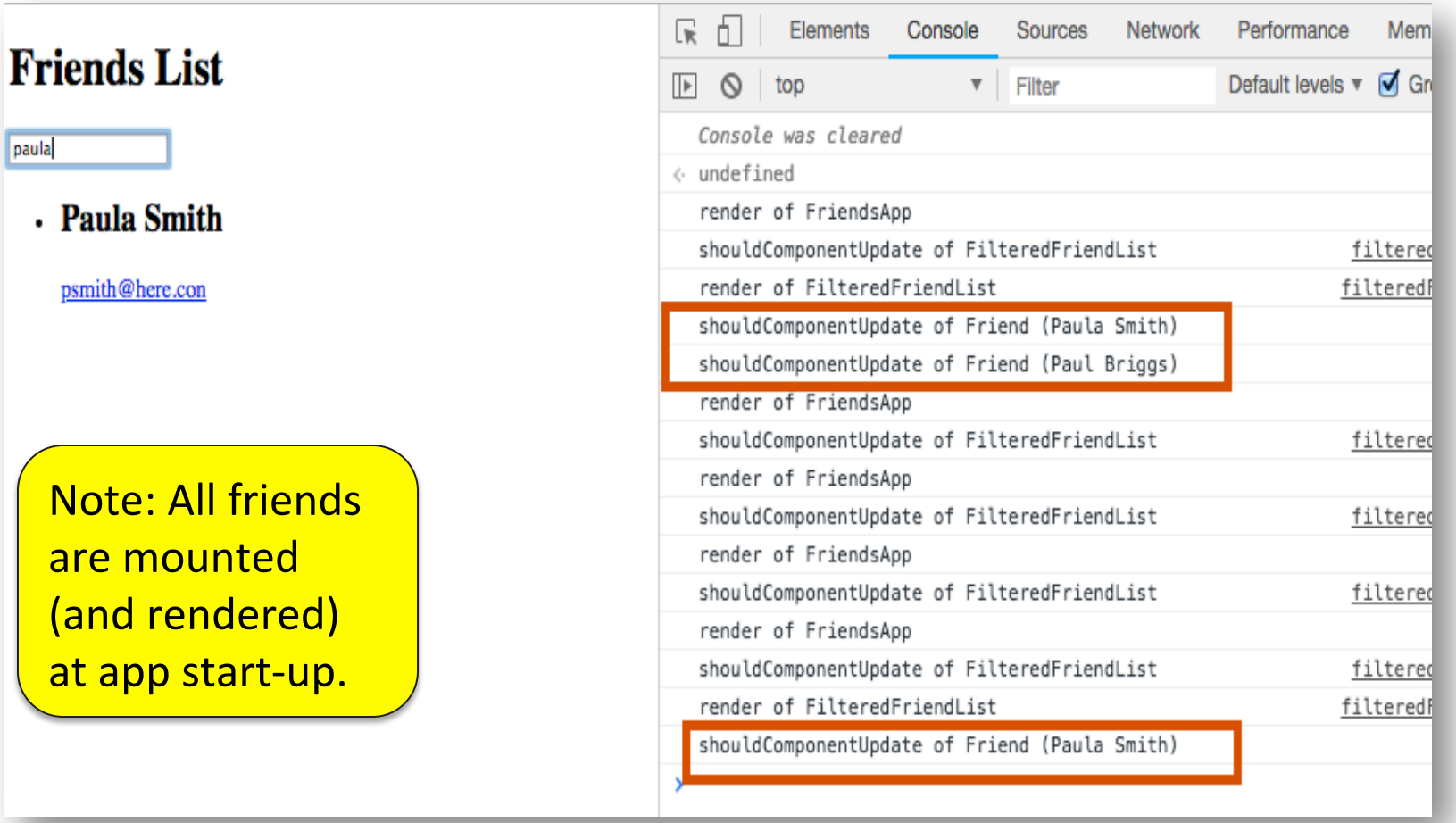
Sample App – Execution trail (Update on new props & setState)..

FilteredFriendsList should NOT re-render if the the length of array prop (of matching friends) has not changed

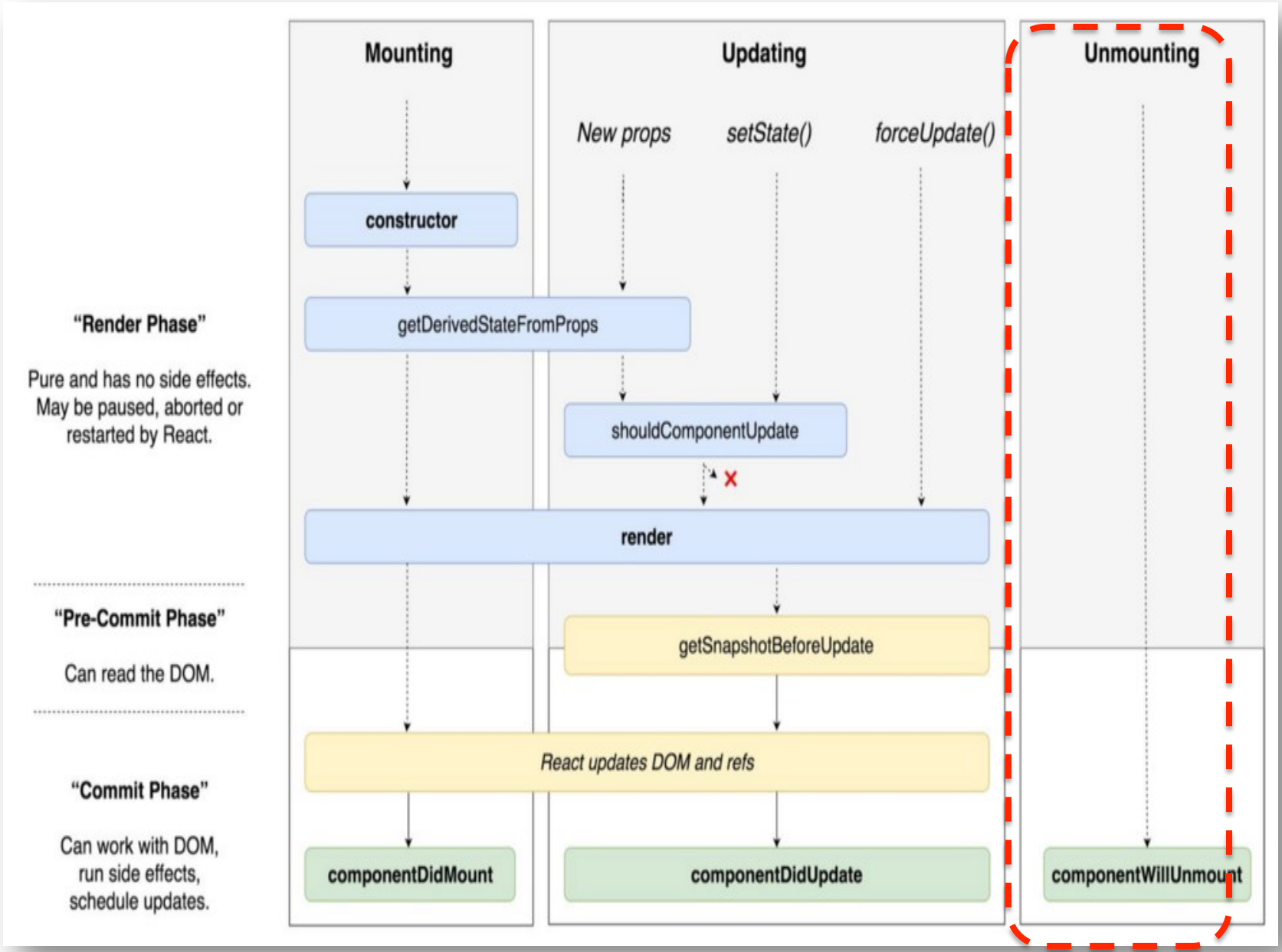


Sample App – Execution trail (Update on new props & setState)..

Friend should NOT re-render once it is mounted



Note: All friends are mounted (and rendered) at app start-up.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Sample App – Execution trail (Un-mounting)..

Summary

- **For interactive apps, store the current 'state' of the UI in component(s) state object.**
- **React achieves DOM update performance improvements by managing a more efficient data structure, the Virtual DOM data structure**
- **A component's life spans from** mounting **to** unmounting**.**
- **A developer can link some logic in to the life span at preceribed times, using prescribed lifecycle methods.**